DARK MATTER AS PAST MATTER

Abstract

Up to now no cosmological model has given a satisfactory frame for the existence of Dark Matter and Dark Energy. Starting from a simple reasoning, this paper attempts to give a logical explanation for both their emergence and existence. It is here theorized that a continuous phase transition, from the three-dimensional space to the one-dimensional time, turns the mass of elementary particles from positive to negative, from the present to the past. Taking inspiration from Dirac's Large Number Hypothesis, it is here explained that both Dark Matter and Dark Energy are the exhaust of ordinary matter, growing with time in one-to-three proportion. Finally also gravitational interaction weakness finds a reasonable explaination.

Article

Time is measurable and then physically existing, there is no apparent reason for not searching whether it has a mass or not. Up to now interacting Dark Matter (DM)[1, 2, 3] has been searched in vain in observable universe. The nature of time - sometimes geometrized[4], although still matter of discussion[5] - has already been described as another dimension[6] like the space. However, the Lambda Cold Dark Matter model (ΛCDM) of a four-dimensional universe[7, 8, 9, 10] has left still unexplained the essence of time[11]. Time is measured by lightspeed. According to Minkowski,[12] light travels in a forty-five degrees angle between the orthogonal axes of time and space, forming a cone. From the vertex of this cone, our present radiates in concentric waves. According to Einstein,[13] spacetime is a whole thing: time and space are strictly connected as the composing sides of a multidimensional manifold. Dimensions set as transversal plans have a long history. In facts orthogonality has made Pythagorean theorem[14] extremely useful in physics. All the charm of such intuition was that adding or subtracting dimensions to a geometrical problem make calculations more handy, and physical reality more understandable[15].

The values three and one are fundamental for Standard Model (SM): from the three space dimensions and the time to the ratio between leptons and quarks electric charge; from the baryons confinement into three colours to the almost one-to-three proportion among baryonic matter and the estimated DM and DE[16] amount in our universe. Three and one seem to be more than just random values and could help out of some of the more inexplicable physics issues of today.

Let's assume time - usually indicated by lightspeed constant – hosting of the space dimensions, just as light is the spectrum of all colours. Then the cube root of lightspeed (massless particle speed), which is $\sqrt[3]{c}=669.278$ m/s or normalized $6.69278e^{2}$ m/s, shows astonishingly similar figures to gravitational constant G, which is $6.67408e^{-11}$ $m^{3}kg^{-1}s^{-2}$, although on a different scale. Nine orders of magnitude is a huge gap. But if gravitational interaction is so weak compared to the other fundamental forces, it may be because it is linked to the time passed since the Big Bang, that is to say proportional to its measure of universe history.[17] Is it by chance that their ratio range is the same of the Hubble density parameter? Is the Hubble constant[18, 19] the effect caused by gravity interaction on space, at the cost of some energy loss during matter phase transition? If so, DE, DM and gravity are definitely linked together[20]. Consequently universe expansion and gravity interaction are aspects of the same field, whose force lines would point towards the centre of bigger mass on the space hypersurface (Gravitational constant), while pointing away from mass worldline (Hubble constant).

Then the past may be not really "flown away". It still physically exists. As new as it may seem, it is not an original idea. In the past the creation of a new kind of matter, due to a sort of phase transition of mass through the flowing of time, had already been formulated. [21]

In fact, Dirac's Large Number Hypothesis[22, 23] seems now able to support the emergence of DM and DE. Dirac predicted literally the creation of two kinds of mass: one "additive" in intergalactic space and one “multiplicative” within matter. About the first, in 1974, Dirac wrote: “*The only way in which we can preserve the Einstein equations, which demand conservation of mass, is to suppose that, together with the H atoms, a uniform distribution of negative mass is created, so as to make the total density of created matter zero. In order not to have violent disagreement with observation we must suppose that the negative mass is not observable and so is not quantized, like the H atoms. It must not interact with other matter, except gravitationally, and must have no physical effects at all, apart from producing a curvature of space. The H atoms condense into nebulae and stars and form the matter that we observe. The negative mass remains uniform and unobservable.”* And about the second: *“Multiplicative creation requires that all forms of matter shall be multiplying, with the number of atoms increasing proportional to* t^2*. It is a little difficult to understand how this can take place in the case of a crystal. Presumably the new atoms must appear on the outside.”* Hard not to recognise in those lines the birth and growth of respectively DM and DE.

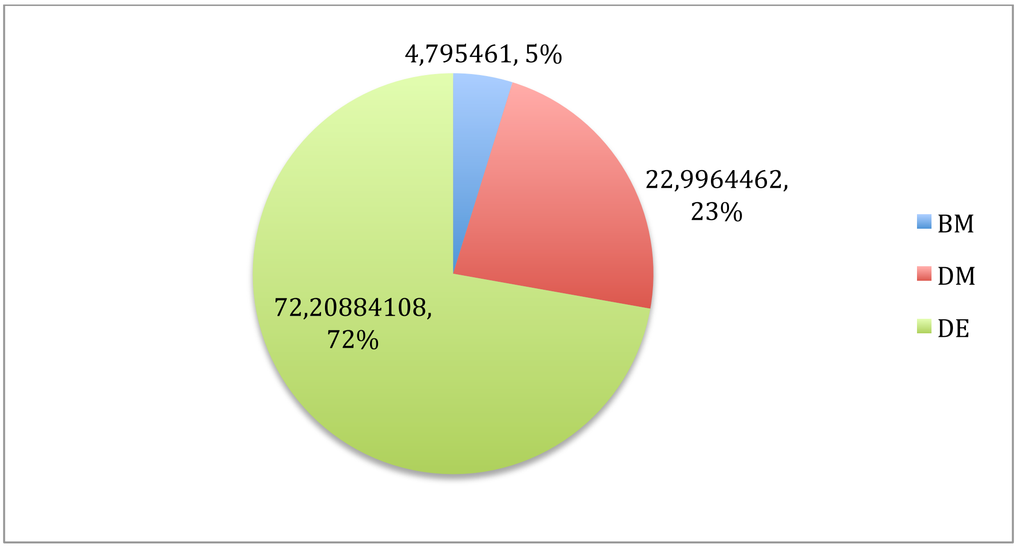
The recent mappings of DM distribution,[24] through the observation of the gravitational pull on celestial bodies, show that DM for the most of cases surrounds ordinary matter in halos[25]. It should be investigated whether those halos correspond to the position of matter in the past. DM core-shaped density in the middle of galaxies may fit well the sum of mass positions through time. Therefore DM halos should stand for a sign of aging of galaxies. The proper motion of stars in galaxies’ nuclei through time would explain why DM density draws cores, instead of cusps.[26] Those projections from the past on the present space surface do not contrast at all with the Partially Interacting DM and Double Disk DM theories.[27, 28] Such shadows of past matter appear bigger than today’s matter, due to the change of proportions between then and the expanded space of today. DM clouds sign the footpath of ancient mass. While matter size remains the same, its past volume (in a thence smaller universe) and its position in space (in the past) are impressed on the expanding space surface as a stain. Matter does not expand with space, neither DM shrinks. Ordinary matter then, occupied major slices of space than today. This is why past matter shadows result bigger than present matter. DM halos condensed in discs around galaxies rotational axis is due to rotational tide.[29] Satellite galaxies co-rotate on the same plan of their mother galaxies, because of the dragging effect of their mother galaxies DM halos.[30]

DM and DE must be aspects of the same multifaceted physical quantity.[31] Gravity emerges where positive (visible) mass dominates, while repulsion rules where negative mass (invisible) prevails, similarly to Chameleon Field Theories.[32, 33] This would explain why bubbles of intergalactic voids seem to squeeze matter into their interstices, along the filaments of a cosmic web.[34] DM and DE one-to-three proportion is caused by the nature of their own dimensions: while DE expands through the three space dimensions, DM grows linearly along one-dimensional time only. Actually, the estimation of ordinary mass (Baryonic Matter, BM) and energy content in the observable universe is reported to be 4.9% for BM, 26.8% for DM and 68.3% for DE. Those estimations can change as more data becomes available. Unless those data will stay untouched, future measurements will cause further revision to proportions unveiling where DM and DE hide in the observable universe. It seems there is a sort of geometrical proportion among them:

$$\mathrm{DE} = \pi \mathrm{BM}^2$$

$$\mathrm{DM} = \mathrm{BM}^2 = \mathrm{DE}/\pi$$

$$\mathrm{BM} = \surd\mathrm{DM} = \surd\mathrm{DE}/\pi$$



Universe expansion[35], [36] (rather that the incorrect idea of explosion)[37] would be the direct consequence of the Big Bang (or Big Bounce) energy wave, in minimal part condensed into matter,[38] expanding from an immensely dense and hot spot to a vastly wider and colder universe.[39] The intangible time straight line stretches as a radius from the centre, shaping with its very top our three-dimensional space hyperplan. Crossing it transversally only, it always measures zero. In fact in every space layer, like the present one, time sizes always zero. Our perception of time derives from a collection of frames put together in a worldline.[40]

Up to now no particle associated with the gravity interaction has ever been observed.[41] Gravitational waves instead, foretold long time ago,[42] have been observed only recently,[43] although its correspondent gauge boson has not been yet recorded, despite all enormous efforts done in accelerators.[44] Experimental physics should look for them along the Universe radius in form of strings. This is why we catch its fingertip only.

In the famous Double Slit Experiment light displays characteristics of both classical waves and particles. Photons travelling through a double slit onto a screen at the front show wave interference, even if shot one by one. How do photons know that there is another slit, through which other photons will pass after them and interfere by drawing dark and light lines on the screen, instead a bright point fading at the borders? Each photon cannot overlap other photons worldlines. The same duality must exist for gravity too. Gravity particle is a string confined in the bulk,[45, 46] stretching all the way from the Big Bang. That might explain its peculiarity, influencing all particles, yet remaining elusive. It should be one-dimensional and bending our space from "below", pulling the cover quilt of space. The reason for which the duality particle-wave (space-like versus time-like) is not evident is because bosons can overlap in space, but not in time. Matter instead, made of fermions, overlap in time (along the worldline), but never in space. During the double slit experiment each photon traces a worldline reaching the wall; that worldline continues to exist. The second travelling photon adds its own history to the first one, tracing another worldline. All worldlines remain traced in time and consequently show interference. Time and space remain bounded, yet not alike. They belong to two transversal plans.[47]

Summoning universe start has triggered a fundamental phase transition originating instantaneously one-dimensional time and three space sub-dimensions. Tetrahedral bundles of strings merged their tips into a foamy hyper-surface.[48, 49] Elementary particles are strings tips. Neutrino oscillations[50] among the three flavours suggest that fundamental matter should be composed by three plus zero distinct observables. What about if neutrino oscillations and their tiny differences in mass reflect each of universe dimensions?[51] They are three massive dimensions for space and one uncatchable for time. Their mass values are so tiny and differ so little that if one day it would be discovered that a kind of manifold fibre[52, 53] is hidden behind strings, it would not be a big surprise.

The hypothesis of DM as a shadow of the past turns upside down the otherwise mainstream theories, according which DM halos formed through gravitational instability and collapse due to cooling of expanding universe.[54] Instead, as in a simple equation, one term passes to the other side, changing its sign. Our space wave front changes mass sign into minus, passing to the negative time domain.

The invisible and intangible past mass, or better, the negative mass[55] remains detectable through gravity interaction.

During the emergence of quant-mechanical anisotropies of cosmological background [56] nucleousynthesis[57] has taken its start. The shadow of past matter projected from the bulk onto the present is DM.[58] Negative mass is attracted by the positive mass[59, 60] to the present, while negative mass reacts within itself with repulsion,[61] stretching out the space where it gathers most.[62] Our sky is scattered by debris of matter, sinking in halos of gravity of their own past.

If Universe expansion is really accelerating,[63] negative mass has then become dominant over positive one and pushes towards additive repulsion. DM continues to exist as gravity source; while negative energy pushes DM halos and clouds one against each other. While time line continues to grow and split itself into three, it blows up the universe. All positive mass becoming negative loses one dimension and releases it as energy, contributing exponentially to the universe expansion.

Analogous particles have already been theorized as gravitons,[64] axions of Bose Einstein condensates,[65] Dirac strings.[66] The past is still there, but dark as DM and DE. Maybe a soliton[67] energy wave front, originated directly from the Big Bang, transforming mass sign, burning its electric charge and engraving space with its signature.

It appears now clearer that dimensions may shape the different features of the multifaceted nature of universe:[68] no-dimensional as in the singularity, one-dimensional as in quantum-mechanical world, bi-dimensional as black hole surface,[69] three-dimensional as the space, four-dimensional as our Universe. Even the divergence between Quantamechanics (QM)[70] and Standard Model (SM) may lie in a difference of their points of view, specifically in the number of dimensions concerned. QM equations tell of a one-dimensional world with two degrees of freedom. It is a binary description of nature, while SM is four-dimensioned. Or the divergence lies entirely in a matter of magnitude: QM is applicable when no more than one dimension is appraisable, while at the size of cosmological observations all four become relevant, as in SM. The holographic principle[71, 72, 73] and the ER-EPR[74] equivalence are further examples of concepts rendered under different number of dimensions. Dimensional phase transitions occur in black holes physics,[75, 76] when the space curve induced by gravity field reaches its ninetieth degree (when gravity field reaches its peak), and becomes orthogonal, then it returns back one of the three dimensions as energetic relativistic jets.[77] The leftover two dimensions get squeezed onto the surface of a ball with no space inside. Nothing falls inside, because when matter crashes onto it, it finds no interior,[78] and ends up spread onto the two-dimensional black hole surface.

Nevertheless there is no reason to think that universe turbulence and cooling can cause few phase transitions only and not more. Future further phase transitions may lead to an increase in the number of dimensions, bringing universe volume and surface to reduce[79] dramatically, into what it may become its very start again.

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